

## ECA Update: January 4, 2016

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### Calendar

**State of the Union**  
January 14, 2016  
9:00 PM EST  
Watch on  
[White House website.](#)

**DOE Consent-Based Siting Public Meeting**  
January 20, 2016  
1 PM - 4 PM EST  
Marriott Renaissance

Just in time for the new year, researchers at the Department of Energy's Oak Ridge National Laboratory have unveiled the fruits of a different kind of energy research: For the first time in nearly three decades, they've produced a special fuel that scientists hope will power the future exploration of deep space.

The fuel, known as plutonium-238, is a radioactive isotope of plutonium that's been used in several types of NASA missions to date, including the New Horizons mission, which reached Pluto earlier in 2015. While spacecraft can typically use solar energy to power themselves if they stick relatively close to Earth, missions that travel farther out in the solar system — where the sun's radiation becomes more faint — require fuel to keep themselves moving.

Plutonium-238 satisfies this need by producing heat as it decays, which can then be converted into electricity by NASA's radioisotope power system, a kind of nuclear battery called the Multi-Mission Radioisotope Thermoelectric Generator, or MMRTG. Excess heat from the MMRTG can also be used to keep some spacecraft systems from freezing in cold environments — a service it's been providing for the Curiosity rover on Mars, for instance.

While other isotopes could theoretically also get the job done, plutonium-238 is ideal because of its "unique combination of properties," said Rebecca Onuschak, a program director in the Department of Energy's Office of Space and Defense Power Systems. Most notably, it's safer to work with than many other types of radioactive materials.

"It's easier to work with and get close to than other kinds of radiation," Onuschak said. "You can make it into a ceramic material that's very safe. It has a long enough half-life that we can do long missions, but it also produces a lot of heat per unit mass."

But despite its importance for space exploration, the fuel has been out of production for close to 30 years now. It was originally produced at the Savannah River plant in South Carolina as a byproduct in the production of defense nuclear isotopes during the Cold War, Onuschak said. But production was discontinued in the late 1980s when the defense missions ended and the reactors were shut down.

Fortunately, the government had some extra fuel stocked, and in

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**Save the Date:**  
DOE National Cleanup  
Workshop  
September 14-15, 2016  
Hilton Alexandria Mark  
Center  
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the intervening years also was able to purchase a little more from Russia to add to its stores, which NASA has been drawing on for missions ever since. But “we knew we were going to eventually need more,” Onuschak said. So in fiscal year 2011, Congress allocated funding for a new project.

Over the past several years, scientists at Oak Ridge National Laboratory have worked on designing new ways of creating plutonium-238. They’ve had to work with smaller reactors than the ones formerly used at Savannah River, said Bob Wham, a plutonium-238 technology integration manager at Oak Ridge National Laboratory.

In order to create plutonium-238, scientists have to apply certain nuclear reactions to a substance called neptunium-237. “We had to design new ways to introduce the neptunium into the reactor, and then obviously pull that material out of the reactor and go through the chemical processing steps to recover and purify that plutonium,” Wham said.

Eventually, their labors paid off. On Dec. 22, the Department of Energy announced that researchers at Oak Ridge had managed to produce 50 grams of plutonium-238 — a feat that hasn’t been performed since production was halted at Savannah River. It’s a big step forward for future space missions. Currently, there are only about 35 kilograms (or around 77 pounds) of stored plutonium-238 left, and only half of that is immediately usable. As the fuel ages, it cools off and becomes less useful — but Onuschak said that old fuel can be mixed with new fuel as it’s produced to extend the substance’s life.

What’s available now will still be enough to get NASA through its next planned Mars mission — the Mars 2020 rover — but if NASA wants to continue sending missions like New Horizons into deep space, it will need new stores of fuel in the future.

Researchers at Oak Ridge plan to collaborate with facilities at Idaho National Laboratory and Los Alamos National Laboratory to begin scaling up production, Wham said. By the end of the decade, they’re hoping to be producing several hundred grams of fuel per year — and by the early 2020s, they hope to be up to a kilogram and a half.

In the meantime, NASA’s Radioisotope Power Systems program will also be funding research into the development of more efficient MMRTGs — that nuclear battery used to supply

electricity to spacecraft. According to the Department of Energy, researchers in the program are hoping to produce a new MMRTG that would be able to provide about 25 percent more power at the beginning of a mission and up to 50 percent more at the end.

The revived interest in fuel production and efficiency signals the start of a new era for space exploration — one which many enthusiastic scientists have had a hand in, Wham said.

“We’ve got a lot of great people in Oak Ridge that are working on [the project], as well as people in Idaho and Los Alamos national labs,” he said. “It’s great to know that there are that many people that are excited and enthusiastic about it.”

### **Savannah River Site could get nearly 2,000 pounds of plutonium for storage**

Augusta Chronicle  
December 29, 2015

[LINK](#)

Savannah River Site appears set to receive nearly 2,000 pounds of plutonium from foreign countries for “storage and process pending final disposition,” according to documents released by the Department of Energy.

According to the “Finding of No Significant Impact” document, the National Nuclear Security Administration has decided to move forward with transport of up to 1,984 pounds of plutonium to Joint Base Charleston.

The material would then be carried in “specially designed transporters” to SRS, where it will be repackaged to meet storage requirements – some of it stabilized – before being moved to the storage area, according to the document.

“The potential environmental impact associated with the transport, storage and processing of the gap material plutonium entail minor impacts and low risks, and do not constitute a major federal action significantly affecting the quality of the human environment,” the document said.

Gap material plutonium is “separated weapons-usable plutonium currently located in foreign countries and poses a threat to national security; presents a high risk of terrorist threat; has no other reasonable pathway to assure security from theft or diversion; and

meets the acceptance criteria of the storage facility at the Savannah River Site,” NNSA Press Secretary Francie Israeli said.

Though the finding document doesn’t state where the material comes from, Tom Clements, director of the nuclear watchdog group SRS Watch, said a document from the NNSA, detailing the Global Threat Reduction Initiative Removal Program, indicates that materials could come from Japan and some European countries, including the United Kingdom, which he said should raise some eyebrows.

“I consider it nuclear dumping,” he said. “I don’t argue that there is some security and nuclear proliferation risks with this material and that some of it needs to come here, but not material originating from a nuclear weapons state like the UK.”

Clements also contends that the environmental assessment, which was also posted on the Department of Energy’s Web site Monday, was done in “secret” and didn’t allow for public comment.

According to the finding document, a draft of the assessment was sent to South Carolina and Georgia, soliciting their comments during a 15-day review period. The South Carolina Nuclear Advisory Council provided input, though no changes were made to the proposal.

Georgia did not return comment.

“It’s a real concern that they’ve totally cut the public out of the loop in this process,” he said. “I think the public should have had an opportunity to comment, and I think there should have at least been one public meeting in the Aiken-Augusta area.”

The environmental assessment attempted to measure the impact for up to 12 total shipments, though no time line was provided as to when those would take place.

“The details associated with removal activities are classified, and therefore are not included in the (environmental assessment),” Israeli said.

**Paducah Mayor Gayle Kaler on PGDP Cleanup Funding,  
Future of Site**

WKMS.Org

December 29, 2015

[LINK](#)

The omnibus spending bill approved by Congress earlier this month included \$200 million for continued deactivation and cleanup at the site of the former Paducah Gaseous Diffusion Plant. Paducah Mayor Gayle Kaler says local leaders are already working on securing funding for the next budget cycle.

“It’ll be 20-30 years before that entire site is cleaned up, so we have to continually go to Washington,” Kaler said. “We have to continually ask for those dollars.”

There are currently around 1,600 workers employed in the decontamination work at the former uranium enrichment plant, most of them with Fluor Federal Services. The U.S. Department of Energy awarded Fluor a 3-year, \$420 million contract last summer. Kaler said there have been talks about renewing that contract, rather than rebidding the work.

Meanwhile, Kaler said she supports state Rep. Gerald Watkins’ legislation that would end Kentucky’s nuclear power facility moratorium for sites within 50 miles of former nuclear product manufacturers - a possible boon for Paducah. Kaler said other industries are not going to be attracted to the PGDP site.

“Say for instance, you’re not going to get a Ford Motor Company to go out there and build a manufacturing plant, so it’s got to be a nuclear friendly industry,” Kaler said.

Watkins' bill will be considered when the General Assembly convenes next month.

### **Demolition could start this year on K-27, last of five gaseous diffusion buildings**

Oak Ridge Today

January 2, 2016

[LINK](#)

Information from Oak Ridge Today and the January 2016 issue of “Advocate,” a publication of the Oak Ridge Site Specific Advisory Board

Demolition work could start early this year on the K-27 Building, the last of five gaseous diffusion buildings at the former K-25 site, now known as East Tennessee Technology Park or Heritage

Center. The giant buildings were once used to enrich uranium for nuclear weapons and nuclear power plants, starting during World War II and continuing through the Cold War.

Deactivation work continues at the K-27 Building, preparing it for demolition. At the beginning of December, deactivation of the building was more than 96 percent complete. Workers continue to remove transite paneling on the building, but that job is 80 percent complete.

Sue Cange, manager of the U.S. Department of Energy's Oak Ridge Office of Environmental Management, has previously said that demolition work could start on the building in early 2016 and be complete by the end of the year.

Demolition work on the former K-31 Building, the fourth of the five buildings to be demolished, was completed in June.

The former K-25 site, which has also been known as Oak Ridge Gaseous Diffusion Plant, was built during the Manhattan Project in World War II as part of a top-secret federal program to build the world's first atomic bombs. Officials say it helped to win the Cold War, enriching uranium for commercial nuclear power plants and nuclear weapons after World War II.

But operations ended in 1985, and the site was permanently shut down in 1987. DOE then began cleanup operations and—with the help of contractors, a nonprofit organization, and others—is converting it into a large private industrial park in west Oak Ridge.

The cleanup work includes demolition of many of the buildings at the site. In June, Cange said there were once about 500 buildings at ETTP, but 380 of them have been demolished. That includes the former mile-long, U-shaped K-25 Building, which was also used to enrich uranium and was once the world's largest building under one roof.

Besides K-25 and K-31, the other two gaseous diffusion buildings that have been demolished are K-29 and K-33

K-27 is the last remaining gaseous diffusion building. In June, officials said UCOR, the federal government's cleanup contractor in Oak Ridge, had started deactivating the 383,000-square-foot facility to prepare it for demolition. A DOE initiative named Vision 2016 calls for having all gaseous diffusion facilities removed from ETTP by 2016.

Preparation work at K-27 includes removing hazards and deactivating it. The building was not properly shut down in the 1980s, so there was still some enriched uranium inside it, Cange said last summer.

At that time, the combined cost for decommissioning and demolishing the K-25, K-29, K-31, and K-33 gaseous diffusion buildings was reported to be about \$1.5 billion, according to the DOE Oak Ridge Office of Environmental Management. Federal officials had approved a \$292 million baseline to complete the K-27 project. Of that total, about two thirds was expected to fund pre-demolition activities, and a third would fund the facility's demolition.

Officials said that removing the buildings eliminates a nuclear hazard and opens up more ETTP property for reindustrialization and regional economic development.

A contract has also been awarded to demolish an electrical switchyard adjacent to K-27.

More information will be added as it becomes available.

**Kent named deputy assistant manager for administration for DOE Oak Ridge**

Oak Ridge Today

January 3, 2016

[LINK](#)

Melanie M. Kent was recently named deputy assistant manager for administration in the U.S. Department of Energy's Oak Ridge Office.

In her new position, Kent will support the assistant manager for administration in developing and executing policies and plans for public relations, real estate and personal property management, multiple activities involving ORO's management of the 33,000-acre DOE federal reservation in Oak Ridge, and management and operation of some 28 federally-owned facilities, a press release said.

It said Kent brings a wealth of knowledge, skills, and abilities to her new position that will assist managers in the organization to improve the quality and delivery of critical business and technical



services provided to clients in Oak Ridge and the DOE's Office of Science program throughout the United States.

"I am pleased to see Melanie in this role at ORO," said Don Thress, acting ORO manager. "She is a seasoned manager, whose experience and forward-thinking will be of great value to the administration program."

Kent began her federal career in 1979 in the human resources arena. She served as the chief, Federal Human Resources Branch, in the DOE ORO from May 2001 to April 2015, when she was promoted to the position of human resources director at ORO.

Kent has supported DOE on multiple headquarters-level teams and committees during her career. She served as a lead auditor for talent management and strategic alignment on several Human Capital Management and Accountability Program audits. She was an active participant on the core team responsible for the design and implementation of the Department's Corporate Human Resources Information System and was instrumental in the evaluation, selection, and implementation of QuickHire as the department's first automated applicant system and predecessor to the current Hiring Management system, the release said.

Most recently, she has worked closely with the Office of Human Capital Management to stand up the department's Shared Service Center for Science and Energy in Oak Ridge.

Kent has a bachelor's degree in business management with emphasis in human resources from Tennessee Technological University.

She and her husband, David, have two children. They live in Clinton.

More information will be added as it becomes available.

### **Washington AG, DOE file competing proposals for Hanford Nuclear Reservation cleanup**

LegalNewsline.Org

January 2, 2016

[LINK](#)

SEATTLE, Wash. (Legal Newsline) — Washington Attorney General Bob Ferguson and the U.S. Department of Energy (DOE)

recently filed the last of the materials in the state's lawsuit regarding nuclear waste cleanup at the Hanford Nuclear Reservation.

A U.S. District Court judge agreed with most arguments made by the Ferguson in August. He asked both parties to submit updated proposals in November. The court will now go over the proposals.

Washington's updated plan uses specific milestones and reporting requirements that ensure the DOE fulfills its cleanup obligations. The DOE's proposal, however, extends the deadline by years.

Ferguson believes that would give the agency authority to decide unilaterally when deadlines need to be moved even further.

"Our plan provides a clear path forward for Energy to finally uphold its responsibilities at Hanford," Ferguson said. "I am deeply concerned by Energy's proposal to extend deadlines yet again. My office is fighting to ensure Washingtonians get a legally enforceable agreement that protects our environment and holds Energy accountable."

The Hanford Nuclear reservation houses approximately 56 million gallons of radioactive and chemical waste. The state has alleged that the DOE has been substandard in retrieving, treating and safely disposing this waste.

### **Payday arrives for missed MOX milestones at the Savannah River Site**

Aiken Standard

December 31, 2015

[LINK](#)

South Carolina should begin collecting today \$1 million a day from the Department of Energy for the agency's failure to either remove one metric ton of weapons-grade plutonium from the state or process one ton through the Savannah River Site's Mixed Oxide Fuel Fabrication Facility.

However, collecting the money, which would max out at \$100 million a year, may prove to be a challenge since the department has yet to acknowledge Gov. Nikki Haley's attempt to levy the funds or her threat to sue if DOE refuses to pay.

Haley sent a Dec. 14 letter to Energy Secretary Ernest Moniz

announcing her intent to levy \$1 million a day from DOE over the missed milestones for MOX, the nation's current pathway to meet an agreement with Russia by disposing of 34 metric tons of weapons-grade plutonium.

"Promises made must be promises kept," Haley wrote, referring to a 2003 agreement signed by former Gov. Jim Hodges and the Department of Energy.

The individual promise, along with legislation signed by U.S. Sen. Lindsey Graham, R-S.C. – who was in the U.S. House of Representatives at the time – has empowered Haley and Attorney General Alan Wilson to impose the fines.

"South Carolina cannot stand idly by while DOE violates federal laws and fails to fulfill its commitment to the State," Haley wrote in the letter.

Haley has not heard back from Moniz or DOE after sending the letter, and comments from DOE have been brief.

Francie Israeli, a press secretary for the National Nuclear Security Administration, or NNSA, said last month that "the Department is working to meet its commitment to the State of South Carolina." However, she did not specify how soon plutonium intended for MOX would leave the state.

NNSA reported last week that the agency is attempting to do right by South Carolina with its plan to remove six tons of weapons-grade plutonium from SRS.

A "preferred alternative" posted last week by the Department of Energy features a plan to process the plutonium at SRS and send the new form of the material to the Waste Isolation Pilot Plant, or WIPP, in Carlsbad, New Mexico.

However, the removal would not honor the agreement since the plutonium mentioned is not part of the stockpiles intended for MOX.

Still, Chaney Adams, Gov. Haley's press secretary, said removing any plutonium from SRS is a good thing for South Carolina, but only if the federal government follows through on the plan.

"The DOE does not have a great track record of keeping its promises to the people of South Carolina, which is why we will

continue to push them in every way we can to make sure our state is not a dumping ground for others' nuclear waste," Adams said.

### **Downblending, Disposal Best Way to Honor Treaty**

Nuclear Nexus

December, 2015

[LINK](#)

Several of our nation's political leaders involved in the 2000 Plutonium Management and Disposition Agreement (PMDA) agreement with Russia, including Senator Richard Lugar and Governor Bill Richardson, have publicly spoken out in favor of continuing with the Mixed Oxide (MOX) Fuel Fabrication Facility.

While these political leaders understandably have a vested interest in the continuation of their treaty, the Carlsbad Mayor's Nuclear Task Force strongly encourages them to rethink their stated opinions. A cost assessment, the lack of commercial interest in MOX, and information from several recent studies have all demonstrated that the intent of the treaty (removing weapons-grade plutonium) can best be achieved through down-blending and disposal.

When the original Plutonium Management and Disposition Agreement (PMDA) plan was put together in in 2000, the goal was to formulate an agreement that resulted in Russia (in addition to the United States) removing 34 tons of weapons-grade plutonium. That goal hasn't changed. What has changed is the unbelievable rising cost of the MOX plant, some of it from documented mismanagement – it is substantially over budget and significantly behind schedule. What is also new is the expanding evidence that down-blending and burial is the best way to honor our side of the commitment.

The congressionally-mandated study from Aerospace that was released in May predicts the lifecycle cost of MOX Fuel Fabrication Facility project to be around \$51 billion dollars, substantially more than what was originally anticipated, and also significantly more than the estimated \$17 billion cost for the down-blending option. Breaking out the upcoming costs, the remaining expenses for the MOX plant would cost the taxpayers about \$1 billion a year over the next 30 years, so it is certainly responsible for the DOE to look into alternatives.

It is also probably unsurprising that those who stand to profit from

that \$1 billion a year expense are circling the wagons to attempt to defend this costly project. The Areva-commissioned High Bridge Associations Inc. study and a supporting public relations campaign haven't done anything to counter the fact that none of our nation's utility companies are willing to accept the MOX fuel. High Bridge's attempt to claim a different economic comparison than the one outlined above just doesn't add up.

Commercial power plants are loathe to add MOX fuel to their reactor feed because of the high cost of retraining their operators to run a reactor fueled with MOX, restructuring their procedures, and obtaining a license amendment from their regulator to approve using that more reactive type of fuel in their existing reactor. Since the 2000 PMDA, the only potential U.S. "customer" originally identified to accept MOX fuel has changed its mind.

There's no way to justify a \$1 billion a year expense to produce a fuel that nobody is willing to buy. Instead, the Red Team's suggestion of a permanent disposal solution through down-blending and disposal in WIPP guarantees non-proliferation, forever. The materials would be down-blended to put them in compliance with transportation standards, and for security reasons.

High Bridge's report, commissioned by Areva, also attempted to go on the offensive by attacking the capacity at WIPP, which is presently about half full. The report claimed that the legal limit on waste volume would have to be changed to accept the entire inventory, but the report ignores multiple options for addressing WIPP's capacity. Most significantly, less than 5% of the legislated land withdrawn for the repository will be used when the repository reaches the current volume limit set by law. The space beneath WIPP is ultimately limitless.

Furthermore, the report's claim that the design basis at WIPP would somehow be exceeded is also misleading and false. There is no upper limit on the plutonium that can be placed in WIPP, as long as certain compliance standards are met.

The report also makes an unsubstantiated claim that the added fissile inventory to WIPP, should the waste go there, could increase the likelihood of a future criticality event underground. However, the idea of anything going "critical" is ludicrous and physically impossible, an obvious scare tactic used by the authors to deceive the average reader.

Regarding the political side of this discussion, the concern has

been expressed that switching to down-blending would violate the conditions of our treaty. However, at least according to media reports, Russia has already recently indicated a willingness to discuss the option of us down-blending and burying weapons-grade plutonium. Given that their primary interest is in expeditiously removing the plutonium from potential use, why wouldn't they? WIPP will be ready to begin receiving this waste almost as soon as the facility opens. Down-blending and disposal would happen years, maybe even decades, before MOX completion.

In fact, the only gain in nonproliferation from burning MOX fuel is that the plutonium content of the used MOX fuel is an unattractive blend of isotopes, not unlike the plutonium isotope mix in used light-water reactor fuel. Like the existence of commercial used fuel, MOX used fuel still requires resource-intensive active safeguards and security to prevent unauthorized access and use.

Additionally, about 3 metric tons of down-blended weapons grade plutonium has already been disposed of at WIPP. Weapons-grade plutonium, when properly down-blended with inert materials and when safeguards are terminated, is a bona-fide contact-handled transuranic waste. The down-blended excess plutonium would meet WIPP's Waste Acceptance Criteria and, most importantly, would be safely, securely and permanently removed from both the stockpile and the biosphere. Plutonium buried in WIPP is permanently isolated – that's the purpose of deep geologic disposal.

On behalf of the Carlsbad Mayor's Nuclear Task Force, we appreciate Senator Lugar and Governor Richardson's extensive efforts on our nation's behalf and continued service. We hope they will come to realize that the down-blending option for excess plutonium is by far the most responsible course of action.

### **UT Research Has No Connection to WIPP Salt**

Nuclear Nexus

December, 2015

[LINK](#)

Several incorrect conclusions were contained in a recent study, "Deformation-Assisted Fluid Percolation in Rock Salt," highlighted in a November 2015 edition of Science. The University of Texas research effectively concluded that, under certain temperatures, pressures and circumstances, the deformities in salt domes can be porous for some liquids. Other past research has

reached the same conclusion, and some parameters concerning this process have been refined by this research.

Less objectively, the article itself, and then follow-up media coverage about the article, took the conclusions, based on very deep, high-pressure and temperature regimes, and misleadingly extrapolated from them to lower pressures and temperatures when they suggested their findings called into question the viability of radioactive waste repositories in stable salt formations at modest depths.

Salt serves as an optimal repository location for radioactive waste because of salt's ability to "heal" openings made by inserting a repository in compressed salt. Under pressure at depth salt flows. This allows Mother Nature to carry much of the isolation workload by encapsulating the waste material and not letting anything in or out for millions of years.

The results from the University of Texas research do not, in any way, relate to the salt beds that host the Department of Energy's Waste Isolation Pilot Plant near Carlsbad. The UT research specifically involved the stress-mediated permeability increase process in very deep salt domes. WIPP is in a salt bed, not a salt dome, and the structural differences between the two can be substantial depending on geologic setting. More specifically, the UT research was related to geologic deformities that occur deep within actively deforming salt domes, not stable salt formations.

The depth and stability of the formation studied is crucial to the conclusions reached. The process outlined by the UT researchers is only active at depths of between ~6,500 to ~13,000 feet. WIPP and other salt repositories are located ~1,640 to ~2,620 feet beneath the surface. This is not merely a cosmetic difference – the pressures and temperatures in the study were significant contributing variables, and do not exist either at WIPP or in the salt domes being used or considered for use as radioactive waste repositories or oil or gas storage sites either in the US or elsewhere.

There is substantial experience in using stable salt domes along the rim of the Gulf of Mexico at significant depth for the reliable storage of petroleum. The US Strategic Petroleum Reserve is in caverns mined into salt domes from ~2,000 to ~4,000 feet in depth and the natural temperature variations between those depths keeps the crude oil naturally mixing, which is a good thing. There has been no loss from oil entering into the salt in these stable formations. In Russia, several large caverns in domes are being

used for natural gas storage, and there are now several decades of experience with storing helium, a hard to contain gas, about 4,500 feet deep in a salt dome at Orenburg. New salt dome storage facilities for natural gas, and helium, are being constructed in Siberia.

It is worth mentioning that continued studies into the suitability of salt for disposal of high-level waste are warranted and supported by the Carlsbad Mayor's Nuclear Task Force. This testing, which involves adding a spectrum of heat to the underground, should be conducted at WIPP – in bedded salt at the actual depth being considered for a potential repository for heat-emitting waste.

The UT study takes a subjective political turn when it claims a link between its research and radioactive waste repositories in salt. This link does not exist. Unsurprisingly, media outlets pounced on this inference, and the inference quickly became the headline of articles covering the topic. The public was ultimately presented with a misinterpretation that incorrectly speculated that WIPP and other repositories could be more porous than we thought. The UT study recommends some specific research to be done on the repository salt. The recommended work has already been done. It was a part of the site characterization phase of the WIPP repository, and showed that the host rock at WIPP has been in their current configuration for hundreds of millions of years. The WIPP salt beds are not likely to ever be deformed by the conditions described in this experiment. WIPP's salt beds are as immobile into the distant future as they've been in the distant past.